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Impact Assessment of NIRSAL De-Risking Strategies on the Accessibility of Institutional Lending for Farmers in Cross River State, Nigeria

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The creation of Nigeria Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL) was exigent on poor credit delivery to agricultural sector in Nigeria occasioned by high percentage financial risks of most formal financial institutions who lent to the sector. The study assessed the role of NIRSAL in de-risking institutional lending to farmers in Cross River State. Specifically, the study assessed the current challenges and risks faced by farmers regarding institutional lending for agricultural purposes; investigated the level of awareness and understanding of farmers concerning NIRSAL and its risk-sharing mechanism; identified the key factors influencing accessibility and utilization of NIRSAL services; and evaluated the effectiveness of NIRSAL in mitigating and de-risking institutional loans to farmers in the study area. Primary and secondary data were used for the study, and 684 respondents were selected for the study. The data obtained were analyzed using a Likert, Ordered Probit Model, Logit Model and Propensity Score Matching models. The study established a significant gender disparity in awareness and access to NIRSAL services, with female farmers facing considerable barriers (p-values =0.060, 0.072, and 0.050, for the Ordered Probit). The study further showed that previous experience (p-value = 0.000) of earlier government schemes/programmes and how far they were from farmers (p-value = 0.000) positively influenced access to these services, but the overall participation rate remained low at 15.76%. Although farmers could gain substantial financial benefits (N208, 750 ≡ 130.47USD per farmer) from NIRSAL's risk-sharing mechanisms, they were often limited by the distance to financial institutions and to NIRSAL. The study, therefore, recommends among others, that NIRSAL collaborate with Non-governmental organizations and Community-based organizations to facilitate training and outreach efforts, ensuring more farmers are informed about its services; create incentive programmes that encourage farmers to engage with it, such as reduced fees for participation or additional support for first-time users; and collaborate with financial institutions to establish agent banking system in the rural farming communities to serve farmers in these areas due to distance problem to urban centers.
Keywords: Farm business, agricultural financing, financial management, institutional loans, rural employment, food supply.

INTRODUCTION

The constraints to agricultural financing are global, although some regions of the world have been more innovative in applying the principles of agricultural financial management more than others, the operations or principles are basically the micro and macro- management perspectives deployed in managing farm finance. While micro deals with financial management of individual farm business unit, and essentially focuses on how an individual farmer sources for finance and allocates same to alternative uses within the farm; macro, on the other hand, deals with the different sources of raising funds for agriculture as a whole in the economy and its concerned with lending procedures, rules, monitoring and controlling procedures of the different credit institutions (Reddy & Ram, 2013). In most developing countries, the challenge is both micro and macro. Micro because most farmers lack access to credit, and macro because the lending procedures, the high cost of loan administration and interest rates, and collateral presentation makes it very difficult for many farmers to access finance. According to Nouman et al. (2013) and Weng et al. (2020), the ability of remote regions to offer sustainable financial services is a challenge in the developing countries. Despite the contributions of agriculture to Gross Domestic Product (GDP) of most African countries, who are all developing countries, commercial bank lending to the sector is very low. In Sierra Leone for instance, its 3%, Ghana and Kenya, 4%, Uganda, 6%, Tanzania, 12%, and in Nigeria, 9% (Agricultural Financing in Africa: Trends and Insights (n.d), https//safinetwork.org). And this low allocation

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to the sector is attributable to the perceived high agricultural risk among other challenging factors. It is for this reason that the Nigeria Incentive Based Risk Sharing System for Agricultural Lending- NIRSAL was established as agriculture is a very key sector in Nigeria.

As one of the most important sectors in Nigeria's economy in terms of employment, provision of food, and industrial raw materials. The sector employs over 60% of Nigerians and contributes 23.11 % of the Gross Domestic Product (GDP). The potentials of the sector is huge, with a substantial base of natural resources including 82 million hectares of arable land with only 34 million hectares so far cultivated (Mikloda, 2018). In addition to this, Nigeria's population being the largest in African continent has a large domestic market that can support and sustain local production and processing. Despite these potentials, the performance of Nigeria's agricultural sector has not been encouraging over the years as the country has been a net importer of so many agricultural products. For instance, the Federal Ministry of Agriculture report (2011) showed that agriculture import dependency was hurting the economy yearly as Nigeria imports over 1.0 trillion naira (588,235,294.11 USD) in wheat, rice, sugar and fish. This loss in global agricultural market share has cost the country about 10 billion USD annual export opportunity from agricultural commodities such as oil palm, cocoa, groundnut and cotton (Mikloda, 2018). Prior to the discovery of oil in 1967, agriculture was the most important sector of the economy, accounting for more than two- thirds of export earnings (Asuquo et al., 2024). The contributions of agriculture declined drastically during the civil war and after the discovery of oil, caused primarily by the availability of inexpensive imports, which led to reduced domestic production in the sector. Consequently, a nation that had been a major agricultural net exporter and was largely self-sufficient in food production quickly became a net importer of the same commodities. Therefore, there is need for policies rejigging and re-engineering of strategies that will lead not only to improved technology, resource availability and management of agribusinesses but also availability of finance to farmers. Farmers indeed need finance as catalyst to accelerate their adoption of improved agricultural technologies, and for the procurement, maintenance and purchase of other inputs as well as for working expenses (Mikloda, 2018). According to World Bank (2022), finance empowers resource poor farmers especially small-scale farmers, to increase their wealth and facilitate the development of food value chains. One source of finance in most developing countries is credit from formal and informal sources, with most farmers prioritizing the formal sources because of the volume of credit involve. But many financial institutions rather prefer to extend such credits to other sectors because of the quick turnover that comes with those arrangements and transactions. According to National Bureau of Statistics (NBS) (2022), agricultural sector received the lowest of banks' loans and advances in comparison to other sectors in the last 10 years. For instance, the sector got 3.26% of total credit from financial institutions in 2014, and 3.36% in 2024, compared to 41.4% and 48.3% for the industrial sector within the same period (Central Bank of Nigeria – CBN, 2024).

The financial system in Nigeria as it is in many developing countries is ill prepared to finance the shift to sustainable agriculture and agro-food industries. Banks, microfinance institutions, and institutional investors have traditionally been providing very limited resources for the sector; agriculture loan and investments portfolios are disproportionately low compared to the sector's contribution to the GDP. It is instructive to note that food demand is on the rise as a result of the upsurge in population growth of the country which keeps soaring every year, and as observed by the World Bank (2022), that the demand for food will go up by 70% by 2050; and at least 80 billion USD annual investments is needed to meet this demand. It is therefore pertinent that agriculture sector in Nigeria should be adequately finance.

The challenge, as noted by many experts and particularly those in the financial markets is that, the sector's risk profile is debilitating to efficient funding of the sector and managing these risks which include among others, the high loan transaction costs involve in handling large number of small farmers who constitute 80% of the farming population along with their value chains, limits effective demand for loans. According to Southern Risk Management Education Center - SRMEC (2013); risk is endemic in agricultural production, and agricultural financial institutions and cooperatives often derive risks from their borrowers and members. In other words, as borrowers and members risk are realized, their abilities to satisfy debt repayment and contract delivery obligations are negatively impacted. It is on the consequence of these risk factors and particularly to increase lending to farmers that the Nigerian government put forward policies and thought it wise to de-risk institutional lending to farmers by setting up the Nigerian Incentive-based Risk Sharing System for Agricultural Lending – NIRSAL. Birthed in 2010, NIRSAL role was principally to develop an innovative mechanism for unlocking affordable financial products to serve the needs of all farmers especially smallholders and reducing the risks of loans to them under financing programmes offered by banks. Many, however, questioned the creation of NIRSAL when other institutions such as the Nigerian Agricultural Insurance Company (1987), the Bank of Agriculture (2010), et cetera; were already in place and were established for the same purpose of increasing credit flow to the sector. While the core mandate of NIRSAL includes risk sharing, insurance, and bank incentive mechanism, which may be performed by one of the institutions above, NIRSAL goes a step further by absorbing a large chunk (up to 75%) of the risk when they crystallize, to enable the banks and other lenders lend to agriculture more

frequently and comfortably (Mikloda, 2018). And as expected, NIRSAL presence is tailored to be felt in the 36 states that make up Nigeria including Cross River State. NIRSAL scorecard since inception includes; the facilitation, purchase and distribution of 2000 units of farm tractors, credit guarantees to 605 Agricultural projects valued at N81.503 billion (41,942,941USD), guaranteed 40% of the Federal Ministry of Agriculture's Growth Enhancement Scheme (GES) Projects valued at N62.49 billion (36,470,876.47 USD), paid interest Draw Back to GES beneficiaries at N439.82 million (258,235.77 USD), and trained 407,000 farmers and primary producers in 4 value chains of rice, cocoa, cotton and tomato. The question is, how is the risk sharing mechanism operationalize? The CBN provides funding for the scheme and sets the overall policy direction. Eligible borrowers (farmers, agricultural cooperatives, agro-processors) who meet the eligibility criteria set by NIRSAL can apply for loans from participating banks by submitting loan applications to the banks. NIRSAL then conducts credit risk assessment on the loan application to determine the creditworthiness of the borrowers; NIRSAL provides a loan guarantee to participating banks to cover up to 75% of the loan amount in case of default. The loans are subsequently disbursed to approved borrowers and are monitored/supervised by NIRSAL and the banks to ensure their use for intended purposes. Under the scheme, interest rate is capped at 9% and the loan tenor is between 6 months to 5 years depending on the agricultural activity.

In view of the achievements recorded so far, this study was undertaken to review the effectiveness and impact of NIRSAL in de-risking lending to farmers in Cross River State following the milestones recorded. Consequently, the study was guided by the following objectives;

i. Assess the current challenges and risks faced by farmers with regards to institutional lending for agricultural purposes
ii. Investigate the level of awareness and understanding of farmers as regards NIRSAL and its risk sharing mechanism
iii. Identify key factors influencing accessibility and utilization of NIRSAL services in Cross River State
iv. Evaluate the effectiveness of NIRSAL in mitigating and de-risking institutional lending in Cross River State

The closest attempt at studying NIRSAL's role after more than ten years of existence has come from Mikloda (2018), who captured among others, the objectives of the agency, the major pillars, the strategy adopted, and the products and scorecard of the agency. This study is different and has opened a new vista by identifying factors influencing accessibility and utilization of NIRSAL's services, as well as how effective the agency has been in de-risking lending to farmers by narrowing such to Cross River State. In addition, models such as Ordered Probit and Propensity Score Matching were also deployed in analyzing key variables involve in the agency's de-risking activities.

MATERIALS AND METHODS

This section focuses on describing the study area – Cross River State, the sampling used in selecting the participants and/or the respondents, and the statistical technique deployed in evaluating the data. Objectives 1 and 2 were analyzed using a five-point Likert scale and Ordered Probit Model; while the Logit and Propensity Score Matching models were deployed in the analysis of objectives 3 and 4.

***Description of the study area*:** Located within latitude $4^0 28'$N and $6^0 55'$N, and longitude $7^0 50'$E and $9^0 28'$E of the Greenwich Meridian in the south-south geo-political zone of Nigeria, Cross River State (the study area) was originally created on the 27th May, 1967 as part of the Eastern region of the country (Cross River State Economic Empowerment and Development Strategy- CR-SEEDS, 2007). Named after Cross River, one of the largest rivers in the state and which also stands out as one of the geophysical landmarks of the territory, the state as at 1967 was called the South-Eastern State before it was renamed in 1976. In 1987, a part of it was further excised and called Akwa Ibom State. With its capital as Calabar, the state as presently constituted occupies a total land area of 20,156km^2 (7,782 sq mls), which is the 19th largest in Nigeria, and is ranked 27th out of the 36 states in terms of population size (www.crossriverstate.gov.ng). The total population as at 2022 stood at 4,406,200 with a density of 220/km^2 (570/sq. miles). Like most states in the country, which are either bordered by countries, water bodies or other states, Cross River State shares its territory to the north with Benue State, to the west with Ebonyi and Abia States, to the east with the Republic of Cameroon, and to southwest and south-south with Akwa Ibom State and Atlantic Ocean, respectively.

The annual temperature averages 28^0C, with rainfall between 2942mm-3424mm. This gives the state its unique flora and fauna with five distinct ecological zones represented – mangrove and swamps forest towards the coast, rainforest in some parts of north and south of the state, montane vegetation/climate in the Obudu plateau, and savannah woodland in most north of the state. This diverse climate and vegetation permit the growth of crops such as, cocoa, oil palm, cassava, plantain, vegetables, etc; which are supported by *ultisol* and *alfisol*, the dominant soils in the state. As an agrarian state with 42% GDP contribution from agriculture and mostly from 80% of small scale farmers, who form the bulk of the farming population, the state sat on the 14th position with a total GDP of 26.33 billion USD and per capita of 5,892 USD as at 2021 (NBS, 2021). Although bless with a vegetation and agricultural features such as climate and soil that can support the growth of crops and animals, farmers in the state also faced some challenges in carrying out

production and these include; limited access to finance and credit, limited market access, high post- harvest losses, and poor infrastructure such as roads, electricity and water supply. Three major ethnic groups: the Efik, the Ejagham, and the Bekwarra, are spread across the length and breadth of the 18 local governments that make up the state.

It is on the strength of agricultural contributions to the economy of the state that this study was undertaken to review NIRSAL impact in de-risking lending to farmers as this is a key component to sector's growth and productivity.

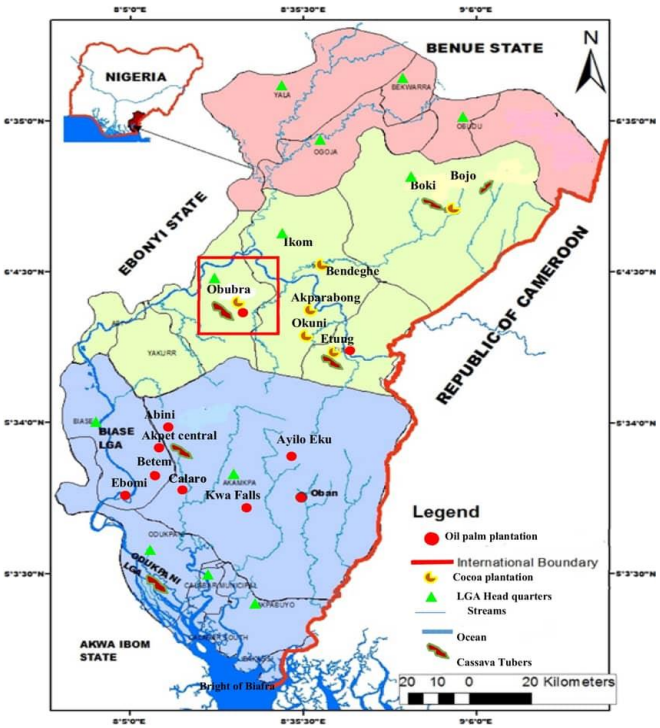

Figure 1. Map of Cross River State, showing the respondents distribution in the study area.

***Sample size, sampling procedure and data collection*:** The population of study consisted of farmers who had registered with NIRSAL and another group of farmers who had not. And from the list of registered crop, livestock, and fish farmers as provided by NIRSAL was farmer population of 1130. The list of the other group was just farmers listed with Cross River Agricultural Development- CRADP, who never enjoyed any NIRSAL service. The population of this latter group was 14,820. From these two populations, a sample size was drawn using Taro Yamane formula (Eboh, 2009).

$n = N/1+N (e^2)$

So, using the formula, the sample size was calculated at ±5% error margin thus:

NIRSAL beneficiaries: $n = 1130/1+1130 (0.05^2) = 295$

NIRSAL non-beneficiaries:

$n = 14,820/1+14,820 (0.05^2) = 389$

It follows, therefore, that for this study, 684 (Beneficiaries and non-beneficiaries) was the sample size used. Since the state has three agricultural zones (Calabar, Ikom, and Ogoja), this sample size was distributed among the zones. Considering the fact that Calabar zone has 7 blocks, Ikom and Ogoja, 6 and 5 blocks, repectively; accordingly, for Calabar zone: 115 NIRSAL beneficiaries and 151 NIRSAL non-beneficiaries, Ikom zone: 98 NIRSAL beneficiaries and 130 NIRSAL non-beneficiaries, Ogoja zone: 82 NIRSAL beneficiaries and 108 NIRSAL non-beneficiaries were selected and sampled. In all the three zones, 50% crop and 50% livestock/fish farmers (both small and large scale) were randomly selected using the random numbers table (Mendenhall & Reinmuth, 1982). Open Data Kit (ODK) collect was then used in obtaining the relevant primary data for analysis. Data such as farmer's socio-economic characteristics, challenges/risk faced in accessing institutional loans, level of awareness and influencing factors of NIRSAL services, as well as how effective the agency has been in de-risking lending were the data collected. The study considered farmers who had benefitted from the scheme in the last three (3) years.

***Method of data analysis*:** In analyzing the data collected based on the specific objectives; both descriptive and inferential statistics were used. Objective one was analyzed using a five-point Likert scale, objective two were analyzed using the Ordered Probit model, objective three was analyzed using the Logit Model, and objective four was analyzed using the Propensity Score Matching (PSM).

Models specification

***Ordered Probit Model*:** This model considers an ordinal dependent variable where respondents can express their level of awareness/understanding using different categories such as 'high', 'medium' and 'low'. In this case, the independent variables would be factors that potentially affect the level of understanding such as farmers' education level, experience with previous agricultural schemes, access to information, age, gender, marital status, and income level. Therefore, given the assumption of normality, the probability that a farmer chooses 'high', 'medium' or 'low' is given as Y_i (where Y_i is the unobservable utility index) and X_i are the explanatory variables.

$P_i = P (Y -1/X) = P(I_i \leq I_i) = P (Z_i \leq \beta_i+\beta_2X_i) = f(\beta_1 + \beta_2 Xi)$

It follows that, $Y_i = \beta_1+\beta_2X_i+\beta_nX_n$

Consequently, Y_i = "high, "medium" or low" awareness/ understanding

Where; high = 3, medium =2 and low =1

X_1 = Education level (Number of years of schooling)

X_2 = Experience with previous agricultural schemes (No experience = 0, Otherwise, =1)

X_3 = Access to information (No access= 0, Otherwise =1)

X_4 = Age (Years)

X_5 = Sex (Male =1, Female =0)

X_6 = Marital status (Single/Divorced/Separated = 0, Otherwise = 1)
X_7 = Income level (Amount of income earn annually in naira)

Logit Model

The logit model is given as:

$L_i = In\ (P_i/1\text{-}P_i)\ \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + U$

Where; P_i = accessibility to NIRSAL services
1-Pi= No access to NIRSAL services
β_1-β_6 = Coefficients
X_1-X_5 = Explanatory variables
Therefore, (P_i) = 1 = Access, otherwise = 0)
X_1 = Farm size (crop = hectares livestock = herd number)
X_2 = Income level (Naira/annum)
X_3 = Education level (years of schooling)
X_4 = Distance to NIRSAL office (in kilometers)
X_5 = Easy access to transportation network to NIRASAL office (Access = 1, otherwise = 0)

***Propensity Score Matching (PSM)*:** To evaluate the effectiveness of NIRSAL in mitigating and de-risking institutional lending to farmers, PSM was deployed. PSM is a conditional probability of receiving a treatment given pretreatment characteristics (Rosenbaum & Rubin, 1983). The PSM was computed using binary probit regression models given as:

$P\ (Y=1 \mid X) = \alpha + \beta_1 Gender + \beta_2 Age + \beta_3 Edu + \beta_4 Hhsize + \beta_5 fexpr + \beta 6income + \beta_7 Transnk + \beta_8 Awareness$

Dependent Variable: Participation in NIRSAL (binary: 1 for participation, 0 for non-participation).
Independent Variables:
X_1 = Gender (Male = 1, Female = 0)
X_2 = Age (Years)
X_3 = Edu = Education level (Years of schooling)
X_4 = Hhsize = Household size (Number of persons in a household)
X_5 = fexpr = Farming experience (Years)
X_6 = Income (Farm annual income in naira)
X_7 = Transnk = Transport network (Means of Transportation to NIRSAL office: By road = 1, otherwise = 0)
X_8 = Awareness (Aware of NIRSAL services = 1, otherwise = 0)

The propensity score was calculated based on the results of the Probit regression, which indicates the likelihood of a farmer participating in NIRSAL. To analyze the causal effect of NIRSAL services on farm income, two matching algorithms were employed - Nearest Neighbor Matching (NNM), which matches each treated farmer with the closest untreated farmer based on the propensity score. Average Treatment Effect on the Treated (ATT) was estimated to evaluate the impact of NIRSAL services on the income of farmers who participated in the program. Given as:

{ATT} = E[Y(1) | T=1] - E[Y(0) | T=1];

Treat_ i = (1 = farmers who benefitted from NIRSAL services, 0 = otherwise).

Multiple tests were conducted to assess the quality of matching, including t-test - to compare means between treated and control groups for various covariates, and Standardized Percentage Bias - to measure the bias in covariates before and after matching. The Mean Bias/LR (χ^2) Tests was also conducted to assess the overall balance of covariates in matched samples.

RESULTS AND DISCUSSION

***Challenges faced by farmers as regards institutional lending for agriculture*:** Table 1 presents an evaluation of the challenges faced by farmers with regards to institutional lending in the study area. The study's mean score and/or bench mark was 3. A challenge ≥ 3 was termed serious, <3, not serious. Accordingly, the challenges were ranked according to the weighted mean of responses across seven questions. These weighted means helped to quantify the severity of each challenge, with a lower mean indicating a lower perceived challenge and a higher mean indicating a greater perceived challenge. The standard deviation provides insight into the variability of the responses around the mean. Distance to the banks for the farmers had a weighted mean of 3.299 and a standard deviation of 0.988, ranking first as the most significant challenge. This challenge for the respondents may be the difficulties experienced from transportation costs occasioned by the recent increase in pump price of premium motor spirit, which had more than tripled the cost of fare to most destinations and had been particularly expensive for farmers in rural farming communities. However, the relatively low standard deviation (0.987) suggests that respondents had a fairly consistent agreement on the severity of this challenge. From the Table, it is also evident that all other factors were below the bench mark of 3, and conclusively implies that they were less of a problem as earlier imagined. Nevertheless, lack of collateral to apply for formal loan had a weighted mean of 2.766 and a standard deviation of 1.010 and was ranked second, and high interest rate was ranked 7th and the least of the challenges faced, which were against expectations. These two challenges are the key reasons why farmers fail to access loans from formal financial institutions and are part of the reasons for the institutionalization of NIRSAL. In other words, the variables selected for this study were carefully chosen based on literature and earlier studies. Although Shewit & Getamesay (2022) had identified interest rate charged and lending procedure as constraints faced by farmers in acquiring institutional loans, their findings is in disagreement with this study's findings based on the bench mark. This study is also at variance with Akram et al. (2018) who identified inadequate collateral and interest rate as some of the challenges affecting institutional lending. Shobha & Siji (2018) also had similar agreement with the authors mentioned here that, farmers faced the challenge of awareness of farm

credit package, collateral free loan, and collateral security in securing institutional loans. Alabi & Abu (2020) in a study on 'constraints in accessing formal loan among farmers' also revealed that, delays in approval and disbursement of credit, lack of collateral security as well as excessive bank procedures and requirements were among the challenges faced by farmers. The difference between the aforementioned studies and this study is the population of study and the gap in time. These can influence the outcome of the results.

***Level of awareness and understanding of farmers' NIRSAL's risk sharing mechanism*:** Table 2 presents the Ordered Probit Model of respondents' awareness level/understanding of NIRSAL services in the study area. The awareness level was categorized into High, Medium, and low. From the Table, the diagnostics show that the LR = 6.45 and the Log Likelihood = -97.223318, are plausible and significant. The Pseudo R^2 = 0.4321, although in models such as this, the goodness of fit is not very meaningful (Gujarati and Porter, 2009). Nevertheless, the results of the odds ratio reveal that, experience from previous agricultural schemes, respondent's sex, and income level are positively related to level of awareness. These predictors have the likelihood of increasing a respondent's awareness level as regards NIRSAL services in the study area. The likelihood of such awareness, according to the predictors, is greater with sex, followed by experience, and lastly level of income. However, the statistical significance of sex indicates that there is a higher probability of males in the study area having such awareness than their female folks. On the other hand, the odds (the probability of success) changes with 1-unit change in each independent variable, holding all other variables constant. The odds ratio in favour of having a high awareness will increase by -99.98% [(0.0001908-1) x 100] for experience, 5.739% for sex, and -99.80% for income.

The marginal effects also from Table 2 is displayed in line with the levels of awareness as earlier explained. Accordingly, for 'high' level of awareness, level of education, age, and marital status are the predictors that can positively influence 'high' awareness. And for 'medium' awareness, level of education, age, and marital status are also the predictors influencing that level. For 'low' level, experience from previous scheme, sex, and income are the predictors influencers. However, for these three levels, only respondents' sex is the only significant variable. Sex coefficients for high, medium, and low levels are -0.1639242, -0.255704, and 0.4196283, respectively; indicating the impact of being in each awareness category. For high and medium categories, the negative coefficients indicate that, the more the female participants in NIRSAL, the greater the probability of decreased 'high' or even 'medium' awareness of NIRSAL services. This is so because, the coefficients are less than 1, which was the dummy for female respondents. It also follows that, even for the low category, although the coefficient is positive, the probability of a low awareness also increases with female participants. Consequently, higher level of awareness of NIRSAL activities/services can be increased by having more male participation. But this is a bit troubling as more of these schemes are tailored to benefit the female folks more so as to balance the already lopsided gender disparity in the country.

In summary, household level determinants of awareness and understanding of NIRSAL was assessed using the Ordered Probit Model. Among the variables investigated only sex influenced the awareness and understanding of NIRSAL by farmers in the study area. Although the odds ratio was discussed, marginal effects gave a clearer picture as it represents the magnitude of the effects of the explanatory variables on the dependent variable.

The marginal effect for sex was statistically significant at 10 % at all the levels of awareness with high and medium levels having negative coefficients. The results showed that being female will decrease the likelihood of the farmer falling within the high group by 16%, decreases the probability of falling within the medium category by 25.57% and increases the likelihood of females being classified as having low awareness by 41.96 % compared to males.

A report by the World Bank highlights that women farmers produce significantly less than their male counterparts due to inequitable access to resources such as information, inputs, and extension services (Peterman et al., 2011). This disparity directly impacts their awareness levels, as limited access to knowledge and resources restricts their ability to stay

Table 1. Challenges faced by farmers in accessing institutional loans.

Challenges	N	R	S	O	A	Weighted Sum	Weighted Mean	Standard Deviation	Rank
High interest rate	0	12	12	30	85	139	1.299	0.673	7th
Lending procedure	20	40	78	82	26	246	2.299	1.052	5th
Lack of guarantors	5	32	147	52	23	259	2.422	0.938	4th
Lack of collateral to apply for loan	5	116	102	60	13	296	2.767	1.010	2nd
Delay in loan disbursement	10	68	156	36	18	288	2.692	0.989	3rd
Distance to banks	80	72	186	8	7	353	3.299	0.987	1st
No moratorium	25	0	144	16	46	231	2.159	1.129	6th

N=Never, R=Rarely, S=Sometimes, O=Often, A=Always. ≥ 3 = Serious Challenge, < 3 = Not a Serious Challenge.

Table 2. Log of odds and Marginal effects of Ordered Probit Model of respondents' level of awareness/ understanding of NIRSAL services in the study area.

	Odds ratio			High			Medium			Low		
Awareness	**Coefficient**	**SE**	**Z**	**ME**	**SE**	**Z**	**ME**	**SE**	**Z**	**ME**	**SE**	**Z**
Education	-0.021950	0.091408	-0.24	0.00340	0.01420	0.24	0.00530	0.02213	0.24	-0.008710	0.03628	-0.24
Experience	0.000191	0.015099	0.01	-0.00003	0.00234	-0.01	-0.00005	0.00365	-0.01	0.000076	0.00599	0.01
Sex	1.057385	0.539279	1.96*	-0.16390	0.08700	-1.88*	-0.25570	0.14190	-1.80*	0.419600	0.21430	1.96*
Age	-0.012900	0.013430	-0.96	0.00199	0.00211	0.95	0.00312	0.00331	0.94	-0.005110	0.00533	-0.96
Marital status	-0.162310	0.164014	-0.99	0.02510	0.02560	0.98	0.03925	0.04059	0.97	-0.064410	0.06510	-0.99
Income	2.17E-07	9.59E-07	0.23	-3.36E-8	1.49E-7	-2.3E-1	-5.25E-8	2.32E-7	-2.3E-1	8.61E-08	3.81E-7	2.3E-1
/cut1	-1.163380	0.893156										
/cut2	0.313982	0.885719										
Pseudo R^2	0.432000											
Likelihood ratio χ^2	6.450											
Prob > chi^2	0.037											
Log likelihood	-97.223											

informed about best practices. The UN Women policy brief emphasizes that gender gaps in agricultural productivity arise not from inefficiency but from unequal access to agricultural inputs and services (UN Women, 2019). This lack of access contributes to lower awareness levels among female farmers, as they are less likely to receive training or information that could enhance their agricultural practices.

The negative coefficients in the high and medium levels and positive coefficient in the low level for sex in the model underscores significant gender disparities in farmer levels of awareness. The result obtain in this study is in line with studies such as Waikar & Karmarkar (2018); Lusardi & Mitchell (2006) who consistently highlighted how these disparities stem from unequal access to resources, extension services, and education for female farmers. Addressing these gaps through targeted interventions such as increasing access to training and resources for women could enhance their agricultural awareness and productivity, ultimately benefiting broader agricultural outcome.

***Factors influencing accessibility and utilization of NIRSAL services by farmers in Cross River State*:** Table 3 shows the factors that influence accessibility and utilization of NIRSAL services in the study area. According to the Table, the diagnostics: LR $\chi 2$ (6) = 21.86, the Log likelihood = -51.58715, and the Pseudo R^2 = 0.4748, all show that the model is significant and is a good fit. The log of odds coefficients shows that experience from previous schemes and level of education attained were the only two variables that positively impacted NIRSAL services access and utilization in the study area with level of education having the greatest impact. However, their impact still has little or no effect going by the negative percentage value. On the other hand, in terms of significance influence, experience at 1% and distance to NIRSAL offices at also 1%, were the two factors influencing accessibility and utilization. Distance is particularly interesting as the negative coefficient only confirms that the farther away a NIRSAL office is from the farmers, the more probable that the service will not be accessed. The marginal effect shows that there is a 3.92% chance for a farmer who had previous experience with related schemes to make effort in accessing NIRSAL services; and a -3.60% chance of not accessing if NIRSAL office distance is away by a kilometer.

Table 3. Log of odds and marginal effects of the factors influencing accessibility and utilization of NIRSAL services in Cross River State.

	Coeff.	**Odds**	**dy/dx**	**SE**	**Z**	**P>|z|**
experience	0.021	1.021	0.039	0.003	8.400	0.000
Farm size	-0.089	0.915	-0.017	0.313	-0.280	0.776
Income	-1.04e-6	1.000	-1.92e-7	1.81e-6	-0.570	0.566
Education	0.063	1.065	0.012	0.205	0.300	0.761
Distance	-0.195	0.823	-0.036	0.051	-3.780	0.000
Transport	-0.315	0.730	-0.058	0.516	-0.610	0.542
Cons	3.191	24.314		1.405	2.270	0.023
n	107					
LR chi2(6)	21.86					
Prob> chi2	0.0013					
Pseudo R^2	0.4748					

Effectiveness of NIRSAL in mitigating and de-risking institutional lending to farmers in Cross River State

***Estimation of propensity score*:** The probability of farmers' participation in NIRSAL was estimated using the probit model where farmer's socio-economic characteristics were matched to obtain the propensity score. The causal effect of NIRSAL services on farm income was analyzed using the Nearest Neighbour Matching and One-on-One Matching algorithms. The probit analysis as shown in Table 4, highlights the estimation of the goodness of predictors' participation in NIRSAL in view of the fact that the LR statistics is significant and log likelihood is also significant. The coefficients of level of education and awareness equally

depict that the probability of benefitting from NIRSAL services is higher if a farmer should have these qualities. However, with a propensity score of 15.76% (Table 6), which indicates the probability of a farmer participating in NIRSAL with a bit to benefit from activities of the agency is abysmally low, showing clearly that there is a disconnect in participation by farmers in NIRSAL activities in the state.

Table 5. Probit Regression Model for farmers' participation in NIRSAL.

	Coefficient.	dy/dx	SE	Z	P>|z|
Gender	0.06513	0.01244	0.66196	0.10	0.922
Age	0.01330	0.00254	0.01849	0.72	0.472
Education	-0.25121	-0.04799	0.12411	-2.02	0.043
Household size	-0.05625	-0.01075	0.08769	-0.64	0.521
Experience	-0.02968	-0.00567	0.02603	-1.14	0.254
Income	-1.18E-6	-2.26E-7	1.57E-6	-0.75	0.452
Transport	0.47702	0.09112	0.38627	1.23	0.217
Awareness	-0.83389	-0.15930	0.26794	-3.11	0.002
Constant	1.49717		1.39364	1.07	0.283
n	684				
LR $\chi2$ (8)	15.72				
Prob >$\chi2$	0.0466				
Pseudo R^2	0.4678				

Table 6. Propensity score

Variable	Observation	Mean	SD	Min	Max
	684	0.15767	0.14876	0.00075	0.7451

Apart from the propensity score mean which provides an insight into participation, a propensity score graph gives a further balancing of the quality of match (Adebayo et al., 2015). According to Dehejia & Wahba (2002), the propensity graph test shows visual presentation of overlap of propensity scores between the treated and the control; and a larger proportion of overlap implies a good match of treated and control cases. From Fig. 2, the overlap of propensity scores between the treated and untreated implies a fairly balanced or matched scenario with a few common support region and one treated observation that is off the support region.

***Other matching quality tests*:** In addition to the matching quality test enumerated above, t-test and standardized percentage test were also conducted (Table 7) as well as the mean bias/LR ($\chi2$) test (Table 8). The t-test shows the variance ratio outside [0.36; 2.76] for unmatched and [0.35; 2.86] for matched were removed so as to balance the matching process in the distribution of the covariates in the matched sample. The standardized percentage bias was also within the acceptable range, complementing not just the t-test but others as well and further giving credence to the performance of PSM in yielding estimates of unbiased Average Treatment Effect on the Treated (ATT).

***Impact of NIRSAL services on farmers' income*:** Table 8 presents the income earned by farmers as a result of being serviced by NIRSAL. According to the Table, on the average (ATT), a farmer gets N208, 750 (130.47 USD) per annum as a result of being de-risked by NIRSAL. In other words, getting the agency to be involved in securing such transactions saves a farmer the sum of N208,750 for every N1,000,000 (625 USD) worth of loans guaranteed by the agency. Nevertheless, it is imperative to emphasize that although the agency's services have been shown here to be beneficial, the activities of the agency are not well amplified as the mean propensity score showed that only a privileged few (15.76% of sampled respondents) enjoyed their services.

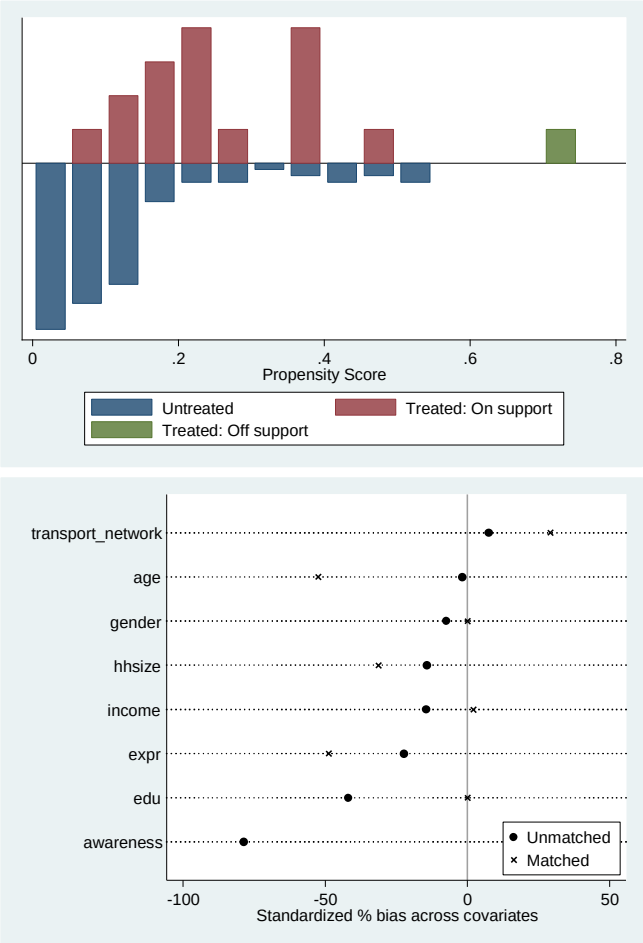

Figure 2. Matched and Unmatched Propensity score of farmers' characteristics in NIRSAL.

***Impact of NIRSAL services on farmers' income*:** Table 8 presents the income earned by farmers as a result of being serviced by NIRSAL. According to the Table, on the average (ATT), a farmer gets N208, 750 (130.47 USD) per annum as a result of being de-risked by NIRSAL. In other words, getting the agency to be involved in securing such transactions saves a farmer the sum of N208,750 for every N1,000,000 (625 USD) worth of loans guaranteed by the

Table 7a. t-test and standardized percentage bias.

Variables	Unmatched Matched	Treated	Mean Control	% bias	% reduct |bias|	t-test t	p>|t|	V(T)//V (C)
Gender	U	1.0588	1.0778	-7.4		-0.27	0.788	0.81
	M	1.0625	1.0625	0.0	100.0	0.00	1.000	1.00
Age	U	52.941	53.144	-1.8		-0.06	0.950	0.65
	M	52.500	58.500	-52.6	-2851.8	-1.36	0.183	0.52
Education	U	3.7059	4.2667	-41.9		-1.69	0.094	1.42
	M	3.8125	3.8125	0.0	100.0	0.00	1.000	0.94
Household size	U	4.9412	5.2556	-14.3		-0.48	0.632	0.44
	M	4.8125	5.5000	-31.3	-118.7	-1.12	0.272	0.88
Experience	U	13.529	15.622	-22.4		-0.73	0.465	0.35*
	M	13.125	17.688	-48.8	-118.0	-1.50	0.145	0.44
Income	U	2.10E+5	2.30E+5	-14.6		-0.47	0.637	0.33*
	M	2.10E+5	2.10E+5	2.0	86.0	0.05	0.957	0.28*
Transport	U	1.1765	1.1444	7.5		0.27	0.790	0.72
	M	1.1250	1.0000	29.1	-290.3	1.46	0.154	
Awareness	U	1.9412	2.4444	-78.7		-3.04	0.003	1.13
	M	2	1.8125	29.3	62.7	0.76	0.451	0.71

Table 7b. Variance ratio

Sample	Ps R2	LR Chi2	p>chi2	Mean Bias	Med BIAS	B	R	%Var
Unmatched	0.168	15.72	0.047	23.6	14.4	112.7*	0.61	25
Matched	0.125	5.01	0.542	24.1	29.2	84.4*	0.72	25

*If B > 25%, R outside [0.5; 2]

Table 8. Average impact estimate of propensity score matching of NIRSAL services on farmers' income.

Variable	Sample	Treated	Controls	Difference	S.E	T-stat
Income	Unmatched	212941.2	228611.1	-15669.9	33090.48	-0.47
	ATT	208750.0	206562.5	2187.5	60470.05	0.04

agency. Nevertheless, it is imperative to emphasize that although the agency's services have been shown here to be beneficial, the activities of the agency are not well amplified as the mean propensity score showed that only a privileged few (15.76% of sampled respondents) enjoyed their services.

***Policy implications/limitations*:** NIRSAL creation was necessitated by the financial risks formal institutions incur in lending to agricultural sector. This is even after schemes and programmes such as Agricultural Credit Guarantee Scheme (ACGS), Commercial Agriculture Credit Scheme (CACS), and Anchor Borrowers Programme (ABP) were earlier introduced to ease credit access to the sector. The food supply-demand gap shows that farmers still lag in the needed finance to shore up production. Given the results of this study, it is imperative to suggest that re-positioning the agency will bolster farmers' finances, giving them the needed leverage to produce more. Since majority of farmers are in rural farming communities, access to finance may be difficult but if agent bankers are deployed by financial institutions with the help of NIRSAL, they could be easily reached, and the challenge of distance to these institutions in the urban, which was identified as a key variable in accessing and use of NIRSAL services can be taken care of. NIRSAL *modus operandi* also should be overhauled as only privileged few were serviced leaving a greater majority. Perhaps, there are some underlining and teething problems that must be overcome to attract more farmers for effective service. This should be a critical area for the agency's consideration.

However, this study had some limitations and it is important to note them accordingly. First, this study only considered the activities of NIRSAL and its impact on formal lending in Cross River State. The impact of the agency may be a lot more significant in other states and therefore, the results here apply only to the study area. Second, the study was conducted within a specified time frame (secondary data was for beneficiaries in the last three years, primary data collected directly from farmers and it was for nine months), expanding this may have a different implication for obtained results. Third, the study deployed the ordered probit and propensity score matching models in analyzing some of the objectives. The use of other analytical technique or models may establish a more in-depth relationship of the variables under

consideration. Finally, by way of suggestion for future studies, expanding and tinkling with the variables as well as considering a few more states will give a clearer picture of NIRSAL activities in de-risking lending to agriculture, and a exploring qualitative study may gain deeper understanding of farmers' experiences with NIRSAL.

***Conclusion*:** This study set out to establish the veracity of the effectiveness of NIRSAL activities in de-risking formal lending to farmers in Cross River State. Both serviced and other farmers were considered and the results showed that only very few farmers were opportune to be de-risked by the agency to the tune of N208, 750 for every N1, 000,000 accessed. Majority were denied access either because of locality or the operations of the agency. To increase coverage, therefore, the study recommends agent banking system as a way of reaching farmers in difficult terrain, and this should be assisted extensively by NIRSAL.

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***Conflict of interest*:** The authors concerted and initiated the study and therefore, there was no conflict of interest.

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***SDGs addressed*:** No Poverty; Zero Hunger; Gender Equality

***Policy referred*:** The Agricultural Credit Risk Guarantee (ACRG) Scheme and the broader Agricultural Transformation Agenda.

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